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About Doe Run

The Herculaneum, Missouri lead smelter is the largest in the country and is one of the most prod facilities in the world. It is located about 25 miles south of St. Louis, on the Mississippi River. The smelter's attractive location facilitates rail, highway and river transportation.

The lead concentrate from the mills is unloaded, mixed and sintered into a self-fluxing blast furnace charge containing 45-50% lead. bullion from the blast furnace is first decopperized, then transferred to the refining department for further processing. The lead is desilverized in the refinery through the addition of zinc, which forms a silver-rich dross by-product. Traces of zinc remaining in the lead are removed by vacuum dezincing.

The Herculaneum

The Herculaneum smelter has a total production capacity of approximately 225,000 tons of refine

In addition to finished grade lead, the smelter recovers by-products in the forms of sulfuric acid, c matte and lead silver bullion for resale.

Doe Run has the capability of producing 99.99% refined lead, possibly the purest commercial lead available anywhere. All lead alloys produced at the smelter utilize high-purity "Doe Run" lead as Each batch of refined lead and alloyed lead is analyzed to determine chemistry. Because of Doe R total quality control from mine to smelter, the lead products are consistent from lot to lot, shipmen shipment.

Sintering

In the sinter plant, the incoming lead concentrate is blended with charge additions and converted t hard, porous "sinter cake" containing about 45-50% lead for the blast furnace.

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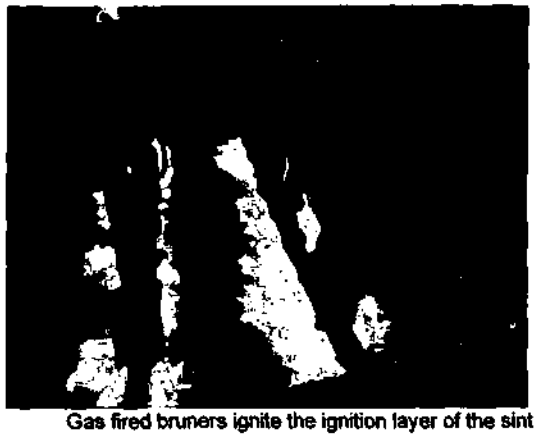
As the first step, the concentrate is mixed with fluxes and internally recycled lead-bearing materials such as baghouse fume. The mixture is then tumbled to form pellets which are fed to the sinter machine.

The sinter machine consists of a slowly moving grate which passes under a line of gas-fired burners.



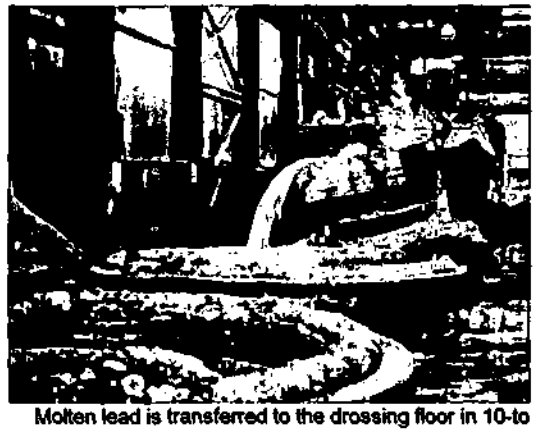
Gas fired bruners ignite the ignition layer of the sint

The lead concentrate pellets are layered onto the sinter machine grate with the bottom layer of pell ignited by the gas burners. The combustion zone is slowly moved from bottom to top by air pushe upward through the bed by large fans. The hot gaseous combustion products contain sulfur dioxid which has been removed from the concentrates. These gases are stripped of all entrained dust and impurities in the baghouses and then converted to commercial grade sulfuric acid in the acid plant. the cakes of sinter are discharged from the sinter machine, the sinter is crushed and screened to a si suitable for the blast furnaces.

Smelting

Lead-bearing Sinter is the main ingredient in the feed for the blast furnace. Sinter is mixed with co and continuously fed through the tops of the blast furnaces.

As the feed descends into the shaft of the furnace, it passes through blasts of hot air and gases. Carbon contained in the coke reacts with the hot air forming chemically-reducing gases, reducing the sinter to molten lead. Flowing from the bottom of the blast furnace, the molten lead collects in special pots and is immediately transferred to the drossing department. At the same time, molten slag composed of reduction by-products is tapped from the furnace, granulated and returned to the sinter department as feedstock.



Molten lead is transferred to the drossing floor in 10-to

Once in the drossing department, the bullion from the blast furnaces is allowed to cool while impu are removed by additional processing. Copper, nickel and other impurities begin to freeze from the solution, forming a layer at the surface called "dross". The dross is skimmed from the surface and separately melted and fluxed in a gas-fired "dross" furnace. The copper sulfide removed at this sta valuable by-product of lead smelting and is sold as a feedstock to copper smelters.

Following final decopperizing, the lead is pumped to the refinery.

Refining

In the refinery, the remaining trace impurities are removed to produce refined lead. In the first step

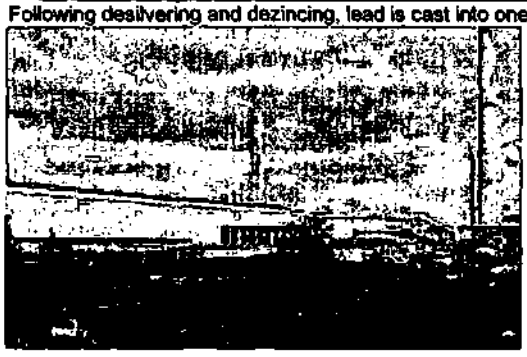
decopperized lead is treated to remove trace quantities of silver.

In this process, zinc is added to attract the silver, producing a silver-zinc dross that is further processed for silver recovery. Because zinc is soluble in lead, it is removed by vacuum distillation.

The result is a 99.99+% pure lead, free of impurities such as bismuth or antimony. Still in molten form, this product is cast into 25-lb. caulking lead links, 60-lb. and 100-lb. pigs, and 1-ton ingots of Doe Run brand pure lead. Additional quantities are alloyed with calcium and/ore tin and aluminum.

All lead products receive careful testing and inspection to insure they conform to Doe Run's rigid quality standards.

Following desilvering and dezincing, lead is cast into one-to



Glover Smelter

The Glover lead smelter is located in Iron County, Missouri about 100 miles south of St. Louis. This plant has easy access to rail and road transportation. The smelter was built in 1968 to process concentrates from Missouri's "New Lead Belt" area. Since then concentrates from Missouri and from around the world have been treated.

Making It Better Tomorrow Than Today

Lead concentrates from the mines and mills are unloaded, mixed, and sintered. The sinter charge c furnace bullion is decopperized before being transferred to the refinery. Silver, zinc, and traces of casting.

The Glover smelter has a total production capacity of 144,000 tons of refined lead. In addition to r silver alloy for resale. Glover produces 99.99% refined lead, commonly called four nines lead. All Each batch of refined lead and alloyed lead is analyzed to assure its chemistry meets customer need

Sintering

In the sinter plant, the incoming lead concentrates are blended with charge additions and converted and suitable for the blast furnace.

First the concentrate is blended with fluxes and internally recycled lead-bearing materials such as baghouse dusts and furnace slag. This blend of materials is weighed and conveyed to a rotating drum for mixing, pelletizing, and moisturizing. The mixture is then fed to the sinter machine.

The sinter machine is hooded and consists of a slowly moving grate which passes under a line of g

The feed mixture is layered on the sinter machine grate with the bottom layers of pellets ignited b the machine, air is blown upward through the bed forcing the flame front to rise slowly from botto through a baghouse where all entrained dusts are removed and recycled back through the process. discharged. The sinter is crushed and screened to a size suitable for the blast furnace.

Smelting

Lead bearing sinter is the main feed component for the blast furnace. Sinter is mixed with coke an furnace is operated at a time.

Oxygen enriched air is blown through tuyere pipes located at the bottom of the furnace. The oxygen in the air reacts with carbon in the coke to generate heat and form chemically reducing gases. As the sinter and coke descend into the shaft of the furnace, they pass through a blast of hot air and gases. At the bottom of the furnace the sinter is reduced to molten lead and slag.

Flowing from the bottom of the furnace, the molten lead is collected in pots and transferred to larg composed of fluxes and reduction by-products is tapped from the furnace, granulated and returned

Refining

In the refinery, batch processes are carried out to remove the remaining trace impurities in order to

In the first step, sulfur and pyrite are added and the remainder of the copper is removed by skimming off the dross. In the next step, the lead is treated to remove the silver. In this process zinc is added to attract the silver, producing silver-zinc crust that is further processed to make a lead silver alloy. Next the lead bath is heated and zinc is removed by vacuum distillation.

The result is 99.99% pure lead, free of impurities such as copper, silver, zinc, bismuth, and antimony. Still in molten form, the lead is cast into 65 lb. and 100 lb. bars, or 1 ton ingots of The Doe Run Company brand pure lead. A portion of the refined lead is further processed by the addition of alloying elements, calcium, aluminum, tin, and copper.

All lead products receive testing and inspection to insure they conform to customer specifications,

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